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(71) Applicant: **Thales Management & Services Deutschland GmbH**
71254 Ditzingen (DE)

(72) Inventor: **Pensold, Rolf**
12459 Berlin (DE)

(74) Representative: **Kohler Schmid Möbus Patentanwälte Partnerschaftsgesellschaft mbB**
Gropiusplatz 10
70563 Stuttgart (DE)

(54) METHOD FOR VITAL COUPLING OF A ROUTE-BASED PROTECTION SYSTEM AND A BLOCK-BASED PROTECTION SYSTEM, TRAIN MOVEMENT PROTECTION SYSTEM

(57) A method for vital coupling of a first protection system (3) and a second protection system (5) for railway traffic on a railway track (1) wherein the first protection system (3) is a route-based protection system and comprises a route capable interlocking (2) and wherein the second protection system (5) is incompatible with the first protection system, wherein the railway track (1) comprises block protected track sections (TS1, TS2) and/or route protected track sections, wherein each track section (TS1, TS2) can assume several states, the states of the block protected track sections (TS1, TS2) being represented by line block sections (10, 11) and the states of the route protected track sections being represented by route sections is characterized in that a block adaption device (7) provides at least one route section (12) for a transition section (TS1), that at least one line block section (11) is provided for the transition section, and that the block adaption device (7) communicates with the route-capable interlocking (2) and with the second protection system at an interface (S). The inventive method enables vital coupling of a two incompatible protection systems while using a standardized interface.

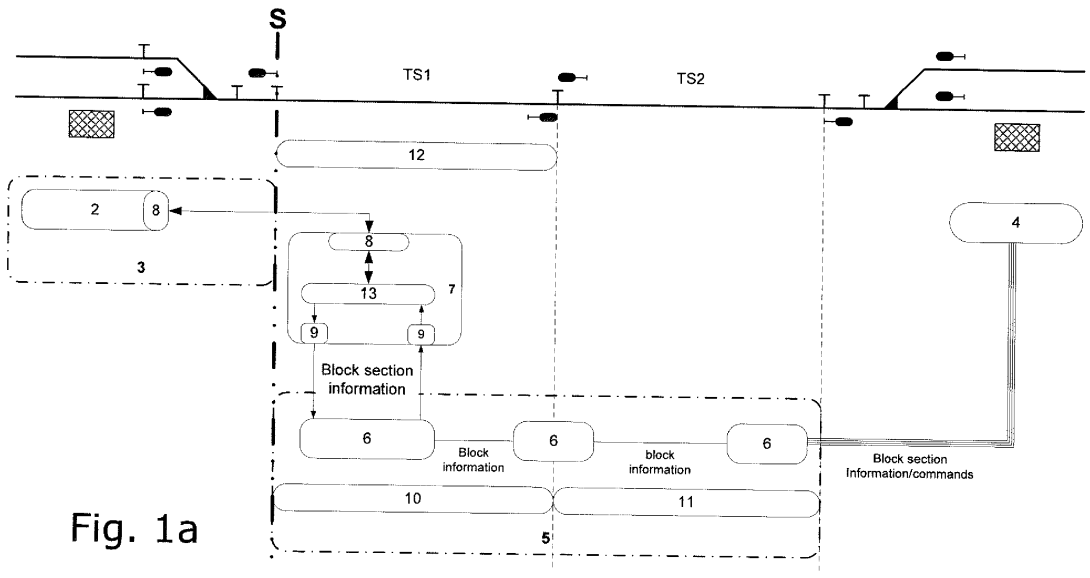

Fig. 1a

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Description

Background of the invention

[0001] The invention concerns a method for vital coupling (in particular coupling which complies with SIL4) of a first protection system and a second protection system for railway traffic on a railway track wherein the first protection system is a route-based protection system and comprises a route capable interlocking and wherein the second protection system is incompatible with the first protection system, wherein the railway track comprises block protected track sections and/or route protected track sections, wherein each track section can assume several states, the states of the block protected track sections being represented by line block sections and the states of the route protected track sections being represented by route sections.

[0002] A method for coupling of a route-based protection system and a block-based protection system is known from existing interlocking and line bock systems, e.g. ESTW Simis W/D, ESTW L90/L90 5, ESTW EBILOCK 950, central block system EB L2000, block system NSI-63/NSB-87, SbL60, RbII60.

[0003] Train movements can be protected by using route-based protection or block-based protection technology. Adaptation between a route-based protection system and a block-based protection system (mostly at the gateways to/from a station to a line) is complex because of the different approaches of protecting train movements which are used in the different protection systems.

[0004] The known ESTW L90/L 90 5 interlocking system for example is a route-based protection system. It can be coupled to a legacy block-based protection system via a line interface, which is the last element of an outgoing route of the route-based interlocking system. As disclosed in [1] - [5] the physical adaptation of the route-based protection system to the block-based protection system is done at a block interface element, wherein a line interface element and the block interface element are positioned in a serial order. A disadvantage of this kind of coupling is that the outgoing route (from a station to a line) has to be adapted every time to a specific version of the block interface element and the legacy block-based protection system which has to be adapted.

[0005] Further a relays/electronical-based adaption of ESTW L90/L90 5 interlocking system (which is a route-based protection system) to the centralized EB L2000/ZbS600 block-adapted protection system is known from [4] and [7]. Adaption elements of ESTW L90 and adaption elements of EB L2000/ZbS600 work together in a serial order and also require specific adaptions.

[0006] From [6] it is known to provide special adaption groups (block adaption, block group station) in order to adapt ESTW L90 to the automatic working block-based protection system SbL60. The adaption groups are working together in a serial order.

[0007] The known adaption methods for coupling a route-based protection system and a block-based protection system define special outgoing and incoming routes which are specific to the requested external block-based protection system to which the route-based protection system is to be adapted, thus in each case individual settings are required.

Object of the invention

[0008] It is therefore an object of the invention to suggest a method for vital coupling of a route-based protection system and a second protection system, which is incompatible to the first protection system without applying specific adaptions of the protection systems.

Description of the invention

[0009] This object is solved by a method according to claim 1 and a train movement protection system according to claim 7.

[0010] According to the invention at least one route section and at least one line block section is provided for a transition section. The route section is provided by means of a block adaption device. The line block section is provided by means of the block based protection system or can be simulated by means of the block adaption device (e.g. in case of an interface-point directly at the second interlocking). The block adaption device communicates with the route-capable interlocking (in particular an electronic interlocking) and with the second protection system.

[0011] The route-based first protection system and the (in particular block-based) second protection system are part of a train movement protection system. The second interlocking can be a block-based interlocking or a legacy route based interlocking.

[0012] The inventive method can be used for a railway track, which is limited by the route capable first interlocking and the second interlocking. The railway track comprises a multitude of track sections, in particular block protected track sections and route protected track sections. The block protected track sections as well as the route protected track sections are arranged in sequence.

[0013] In general, the track comprises not only block-protected track sections but also route-protected track sections, which can assume different states. The states of the route sections and line block sections can be changed (manipulated) during operation.

[0014] Route protected track sections are secured by means of the route-based protection system, which sets the state of the specific track section. Information concerning the state of a route protected track section is provided in form of (represented by) a route section. A route section comprises route section information (incl. the information concerning the state of the respective track section, e.g. "free" or "occupied" and information

concerning the direction of a set route for this track section). A route comprises one or more route sections, i.e. concerns one or more track sections.

[0015] Block protected track sections are secured by means of the block based protection system, which sets the state of the specific track section. Information concerning the state of a block protected track section is provided in form of (represented by) a line block section. A line block section comprises line block section information (incl. information concerning the state of the respective track section, e.g. "not blocked" or "blocked" and information concerning the direction of the overall line for this track section). A line block comprises one or more line block sections, i.e. concerns one or more track sections.

[0016] The block protected track section which is adjacent to the route protected track sections is called "transition section", since the protection system changes from block based protection to route based protection or vice versa. The transition section is block-protected by means of the second protection system. In case the block adaption device is located adjacent to the station of the second interlocking the transition section is a block protected track section of length 0.

[0017] The inventive block adaption device represents a functional connection between the second interlocking and the route-capable first interlocking. Therefore, route sections for the transition section are stored in the block adaption device. For the same transition section line block sections are provided. Thus, the transition section is a track section, which is secured by means of the route-incapable interlocking and the block adaption device, which communicates with the block based protection system as well as with the route-capable first interlocking. The transition section (and thus the border between block based protection and route based protection) may be located anywhere along the railway track. The location of the transition section can be defined according to existing equipment, topology and/or customer wishes and is independent from the location of the equipment (e.g. at the start station just behind the respective interlocking, at the destination station just before the respective interlocking or somewhere else along the track).

[0018] In contrast to the state of the art, the inventive method provides at least one route section for the transition section as well as a line block section for the same transition section. Thereby two securing principles (block based protection and route based protection) are associated with the transition section at the same time, thereby providing a "parallelization" of route section and line block section for the transition section. Information concerning protection of train movement at the transition section will be transformed/translated from route based train movement protection principles to block-based train movement protection principles or the other way around (depending on the direction of movement) by means of the block adaption device. The block adaption device thereby serves as an interlocking "emulator".

[0019] Thus, according to the invention route section information and line block section information concerning the transition section are coupled by parallelization of logical views at the transition section from perspective of the route-based protection system and of the block-based protection system.

[0020] The inventive method allows a route-based coupling between the interlocking of the route-based protection system and the block adaption device while using a standardized interface for coupling external train moving protection systems.

Preferred Variants

[0021] In a preferred variant, the block adaption device receives line block section information concerning the transition section from the second protection system. Line block section information are transmitted from the second protection system to the block adaption device, in particular continuously or event-driven.

[0022] For securing a railbound vehicle from the second protection system to the route-based first protection system (safe movement in direction towards route based protected track sections) it is preferred that the block adaption device sends a route request to the route-capable interlocking if, preferably only if, the line block section information received by the block adaption devices has changed. The route request is send to the route-capable first interlocking in order to receive a route for the route-based protected track sections to be used for movement of the railbound vehicle.

[0023] For securing a railbound vehicle from the route-based first protection system to the second protection system, the block adaption device receives a route request from the route-capable interlocking.

[0024] In other words: Route requests are exchanged between the route-based first protection system and the block adaption device. The block adaption device thereby enables a route-route-coupling of the route-based protection system and the second protection system along the transition section.

[0025] For train movement from second protection system to route based first protection system the block adaption device can set the state of the line block section of the transition section in dependence of the route request received from the route based protection system in case the block section information does not comply with the route request. I. e. the line block section information is manipulated by changing the state of the line block section such that the manipulated line block section information complies with the route request.

[0026] In a preferred variant for train movement from route based first protection system to second protection system the block adaption sets the state of the route section provided by the block adaption device in dependence of the received line block section information. Therefore, the block adaption device checks whether the conditions required for the route section provided by the block adap-

tion device are met.

[0027] The invention also concerns a train movement protection system for securing railbound vehicles on a railway track, the train movement protection system comprising a route-based first protection system with a route-capable interlocking, in particular an electronic interlocking and a second protection system, which is incompatible with the first protection system. The inventive train movement protection system is characterized in that the train movement protection system further comprises a block adaption device with a standardized interface via which the second protection system is connected to the route-based first protection system. I.e. the block adaption device is (electrically) located between the second protection system and the route-based first protection system.

[0028] According to the invention, the block adaption device is adapted

- o to provide at least one route section for a transition section;
- o to receive information (in particular block section information and route requests) from the second protection system and the route-based first protection system and to transmit information (in particular route requests) to the second protection system and the route-based first protection system;
- o to set the state of the at least one route section or the at least one line block section (10'); and

[0029] The route-capable interlocking of the route-based first protection system is adapted/connected to the second protection system via the block adaption device. The block adaption device handles the adaption autarkicly by using both railway protection principles: route based protection principles and block-based protection principles, i.e. the block adaption device is adapted to process data according to route-based technology and data according to block-based technology. Thus, a line block section as well as a route section can be provided for the transition section in parallel with the inventive train movement protection system.

[0030] This has the effect that the first interlocking of the route-based first protection system does not need to be adapted to the specific block-based protection system. This involves a simplification for the route-capable first interlocking of the route-based protection system, since no line block technical, operational, safety specific stuff is required.

[0031] According to the invention, the block adaption device is adapted to carry out a transformation between route section information and line block section information. For doing this, the block adaption device sets the state of the route section of the transition section and/or the line block section according to the received route request.

[0032] In a preferred embodiment the block adaption device comprises a driver device which is adapted to set the state of the at least one route section in dependence of the line block section information received from the second protection system. The driver device is further adapted to set the state of the line block section of the transition section in dependence of the route request received from the route-capable interlocking in case the block section information does not comply with the route request.

[0033] In a special embodiment, the second protection system comprises block groups, which are connected to a route incapable second interlocking, the block groups being adapted for transmission of block information (e.g. direction of train movement, blocking information, signaling information).

[0034] In an alternative embodiment the block-based protection system comprises an adaption groups line interface (Blockanpassgruppe) which is part of a second interlocking, the adaption groups line interface being adapted for transmission of block information.

[0035] In a highly preferred embodiment of the train protection system, the standardized interface is an SCI-ILS interface.

It is preferred that the train movement protection system is adapted to carry out the method described before.

[0036] Further advantages can be extracted from the description and the enclosed drawing. The features mentioned above and below can be used in accordance with the invention either individually or collectively in any combination. The embodiments mentioned are not to be understood as exhaustive enumeration but rather have exemplary character for the description of the invention.

Drawings

[0037] The invention is shown in the drawing.

Fig. 1a shows a schematic depiction of a train movement protection system according to the invention with an interface between block based protection system and route base d protection system situated near the route capable first interlocking of the route based protection system (variant 1).

Fig. 1b shows a schematic depiction of the train movement protection system of Fig. 1a in which parallelization of route section and line block section within the block adaption device is shown.

Fig. 2 shows a schematic depiction of a train movement protection system according to the invention with an interface between block based protection system and route base d protection system situated near the second interlocking of the block based protection system (variant 2).

Fig. 3 shows a detailed flow chart with the method steps of a method according to the invention for a train moving from a route-based protection system to a block-based protection system.

Fig. 4 shows a detailed flow chart with the method steps of a method according to the invention for a train moving from a block-based protection system to a route-based protection system.

[0038] In **Fig. 1a**, **1b, 2** a track **1** is shown comprising track sections **TS1, TS2, TS1**', **TS2', TS3'.** The track 1 is limited by a route-capable interlocking **2** of a route-based protection system **3** and a second (legacy) interlocking **4** which communicates with a block-based protection system **5.**

[0039] The block-based protection system 5 further comprises block groups **6** for processing block information and for transmitting block section information. The block groups 6 can be set up as external devices, as shown in Fig. 1, 2 or can be integrated in the second interlocking 4 as an adaption groups line interface, if the second interlocking is a route based interlocking

[0040] According to the invention, a block adaption device **7** is provided which connects the route-based protection system 3 and the block-based protection system 5. The block adaption device 7 is connected to the route-capable interlocking 2 via a standardized interface **8** and to the block-based protection system 5 via in/out-interface **9.**

[0041] In the embodiment shown in **Fig. 1** track sections TS1, TS2 are block protected by means of the block-based protection system 5. The block-based protection of the track 1 ends at an interface-point **S.** The interface-point S is located directly at the border of route-capable interlocking 2 and track section TS1. Yet, this is not mandatory. In fact, between route-capable interlocking 2 and interface-point S route-based protected track sections can be present.

[0042] For each block protected track section TS1, TS2 a line block section **10, 11** is generated by means of the block-based protection system 5, the line block sections 10, 11 comprising block section information for the respective track sections TS1, TS2.

[0043] Track section TS1, which is adjacent to the route-based protection system 3, is called "transition section". The line block section 10 (comprising line block section information for the transition section TS1) which has been generated by the block-based protection system 5 is fed to the block adaption device 7 via the in/out-interface 9. According to the invention, the block adaption device 7 additionally provides a route section **12** for the transition section TS1, wherein the route section 12 is generated by means of a driver device **13** of the block adaption device 7. In a special embodiment the block adaption device may comprise two driver devices for supporting different legacy protection systems. Thus, for the transition section TS1 both, a line block section 10 as well as a route section 12, are provided in parallel, thereby enabling transition from block-based protection to route-based protection and vice versa over the whole transition section TS1. Therewith a vital coupling of different movement technologies is provided. This is schematically depicted in **Fig. 1b.** The route section 12 can adopt different states. According to the invention, the state of the transition section TS1 is set by the block adaption device 7. By setting the state of the route section 12, block section information is translated into route section information and vice versa.

[0044] In the embodiment shown in **Fig. 2** the track sections **TS1', TS2'** are route protected by means of the route-based protection system 3. The route-based protection of the track 1 ends at an interface-point **S'.** The interface-point S' is located directly at the border of second interlocking 2 and track section TS2'.

[0045] Here, the transition section **TS3',** which is adjacent to the route-based protection system 3 and within which the train is transferred from route based protection to block based protection and vice versa has the length 0 and is located at interface S'.

[0046] Route section **12'** (comprising route section information for the transition section TS3') is provided by means of the block adaption device 7. Line block section **11'** for transition section TS3' is either generated by means of the block based protection system or can be provided by means of the driver device **13** of the block adaption device 7. Thus, for the transition section TS3' both, a line block section 11' as well as a route section 12' are provided in parallel, thereby enabling transition from block-based protection to route-based protection and vice versa within the transition section TS3'. Therewith, a vital coupling of different movement technologies can be realized.

[0047] **Fig. 3** and **Fig. 4** show the different steps for train movement protection for train movement from route-based protection system 3 to block-based protection system 5 (Fig. 3) and vice versa (Fig. 4).

[0048] In case of an intended train movement from the route-based protection system 3 to the block based protection system 5 (Fig. 3), the block adaption device 7 is interacting in the following way to transit the train from the route-based protection system 3 to the block based protection system 5:

1. Block adaption device 7 receives block section information concerning line block section 10, 11' from block-based protection system 5 (Check_1).

2. The route capable interlocking 2 sends a route request to the block adaption device 7, thereby requesting to set a route from interface-point S into the transition section TS1, TS3' (Req_1).

3. The block adaption device 7 checks by means of

driver 13 the compliance of the block section information received from the block groups 6 with the requested route from interface-point S into the transition section TS1, TS3' (Comp_1).

4. In case of an positive compliance, block adaption device 7:

a. sets the state of line block section 10, 11' to state "blocked" (Block_1),

b. sets the state (determination) of the route section 12, 12' to state "locked" (Set_1), and

c. reports a locked route section 12, 12' from interface-point S into transition section TS1, TS3' to the route capable interlocking 2 (Report_1).

5. If the route capable interlocking 2 can set a route to interface-point S too, it is now allowed to open an outgoing traffic signal, for starting the train run.

6. As soon as the train occupies transition section TS1, TS3', driver 13 of the block adaption device 7:

a. sets the state of line block section 10, 11' to "occupied" (Block_2), and

b. reports state information concerning line block section 10, 11' to 2 (Report_5).

7. As soon as the train has completely left the route based protection system 2 (in Fig. 1a the station) the block adaption device 7:

a. receives information about clearance and sets the state "unlocked" for the route section of the outgoing track section, i.e. the track section preceding the transition section TS1, TS3' outgoing from route capable interlocking 2 (Report_3), and

b. stores the information that the outgoing route section of the track section preceding the transition section TS1, TS3' is set to state "unlocked" (Set_3).

8. As soon as the train left the transition section TS1, TS3' completely, block adaption device 7:

a. removes the state "occupied" from line block section 10, 11' (set state "unblocked") (Block_3), and

b. reports clearance of transition section TS1, TS3' to the route capable interlocking 2 (Report_6).

9. Further, block adaption device 7 verifies via block section information, that block section 10, 11' is in state "unblocked"(Check_2) and checks the compliance of determination of route at 12 to state "unlocked" - Comp_2.
In case of a positive compliance the block adaption device 7:

a. sets the state of the route section 12, 12' to "unlocked" (Set_2) and

b. reports the unlocked state for the route section 12, 12' to route capable interlocking 2 (Report_3).

10. Now the procedure for a new train run can be started.

[0049] In case of an intended train movement from the block-based protection system 5 to the route-based protection system 3 (Fig. 4), the block adaption device 7 is interacting in the following way to transit the train from the block-based protection system 5 to the route-based protection system 3:

1. The block-based protection system 5 sets the state of block section 10, 11' to state "blocked". The block adaption device 7 receives block section information concerning information (in particular state information) concerning line block section 10, 11' from block-based protection system 5 (Check_1).

2. Block adaption device 7 is checks by means of driver 13 the compliance of the block section information received from the block groups 6 with the state of the route section 12, 12' for a route from transition section TS1, TS3' to interface-point S (Comp_1).

3. In case of an positive compliance, block adaption device 7:

a. sets the state of the route section 12, 12' with direction from transition section TS1, TS3' to interface-point S to state "locked" (Set_1)

b. sends a route request for entrance route (from interface-point S into route capable interlocking 2) to the route capable interlocking 2 (Request 1).

4. As soon as the route section of an entrance route (from interface-point S into route capable interlocking 2) is in state "locked", an according report is transmitted to block adaption device 7 - Report_2.

5. As soon as the train:

a. occupies track sections behind interface-point S (Report_6) and

b. completely leaves transition section TS1, TS3' in direction to the route capable interlocking 2,

the driver 13 of the block adaption device 7 sets the state of the route section 12 to state "unlocked" (Set_2), then sends an according report to the route capable interlocking 2 (Report_4) and sets the state of line block section 10, 11' at the block based protection system 5 to "unblocked" (Block_1). Now a new train run into transition section TS1, TS3' is possible.

6. As soon as the state of the entrance route is set to "unlocked", this is reported to block adaption device 7 (Report_5). Now a new train run from transition section TS1, TS3' to the route based protection system 2 is possible.

List of Reference Signs

[0050]

1	track
2	route-capable interlocking
3	route-based protection system
4	different route-based protection system
5	block-based protection system
6	block groups/adaption groups line interface
7	block adaption device
8	standardized interface
9	in/out-interface
10	line block section for transition section
11	line block section for block protected track section
11'	line block section for transition section
12, 12'	route section for transition section
13	driver device of block adaption device
14	route section for transition section
TS1	block-protected track section (transition section)
TS1'	route protected track section
TS2	block-protected track section
TS2'	route protected track section
TS3'	transition section of length 0
S	interface-point of block-based protection

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[0051]

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Claims

1. Method for vital coupling of a first protection system (3) and a second protection system (5) for railway traffic on a railway track (1) wherein the first protection system (3) is a route-based protection system and comprises a route capable interlocking (2) and wherein the second protection system (5) is incompatible with the first protection system,
wherein the railway track (1) comprises block protected track sections (TS1, TS2) and/or route protected track sections (TS1', TS2'), wherein each track section (TS1, TS2, TS1', TS2') can assume several states, the states of the block protected track sections (TS1, TS2) being represented by line block sections (10, 11) and the states of the route protected track sections being represented by route sections;
characterized in
that a block adaption device (7) provides at least one route section (12, 12') for a transition section (TS1, TS3'),
that at least one line block section (11, 11') is provided for the transition section, and
that the block adaption device (7) communicates with the route-capable interlocking (2) and with the second protection system at an interface (S, S').

2. Method according to claim 1, **characterized in that** the block adaption device receives (7) line block section information concerning the transition section (TS1, TS3') from the second protection system (5).

3. Method according to claim 2, **characterized in that** for securing a railbound vehicle from the second protection system (5) to the route-based first protection system (3) the block adaption device (7) sends a route request to the route-capable interlocking (2) if,

preferably only if, the line block section information received by the block adaption device (7) has changed.

4. Method according to claim 2 or 3, **characterized in that** for securing a railbound vehicle from the route-based first protection system (3) to the second protection system (5) the block adaption device (7) receives a route request from the route-capable interlocking (2).

5. Method according to claim 4, **characterized in that** that for train movement from second protection system (5) to route based first protection system (3) the block adaption device (7) sets the state of the line block section of the transition section (TS1, TS3') in dependence of the route request received from the route-capable interlocking (2) in case the block section information does not comply with the route request.

6. Method according to any one of the claims 2 through 5, **characterized in that** for train movement from route based first protection system (3) to second protection system (5) the block adaption device (7) sets the state of the route section (12, 12') provided by the block adaption device (7) in dependence of the received line block section information.

7. Train movement protection system for securing railbound vehicles on a railway track (1), the train movement protection system comprising a route-based first protection system (3) with a route-capable interlocking (2), in particular an electronic interlocking and a second protection system (5) which is incompatible with the first protection system (3),
characterized in
that the train movement protection system further comprises a block adaption device (7) with a standardized interface (8) via which the second protection system (5) is connected to the first protection system (3); wherein the block adaption device (7) is adapted

- o to provide at least one route section (12) for a transition section(TS1, TS3');
- o to receive information from and to transmit information to the second protection system (5) and the first protection system (3);
- o to set the state of the at least one route section (12) or the at least one line block section (10').

8. Train movement protection system according to claim 7, **characterized in that** the block adaption device (7) comprises a driver device (13) which is adapted to set the state of the at least one route section in dependence of the line block section information received from the second protection system (5) and is adapted to set the state of the line block section (10, 11') of the transition section (TS1, TS3') in dependence of the route request received from the route-capable interlocking (2) in case the block section information does not comply with the route request.

9. Train movement protection system according to claim 7 or 8, **characterized in that** the second protection system (5) comprises block groups (6) which are connected to a route incapable second interlocking (4), the block groups (6) being adapted for transmission of information.

10. Train movement protection system according to according to claim 7 or 8, **characterized in that** that the block-based protection system (5) comprises a adaption groups line interface (6) which is part of the second interlocking (4), the adaption groups line interface (6) being adapted for transmission of line block section information.

11. Train movement protection system according to any one of the claims 7 through 10, **characterized in that** the standardized interface (8) is an SCI-IL interface.

12. Train movement protection system according to any one of the claims 7 through 11, **characterized in that** the train protection system is adapted to carry out the method according to one of the claims 1 through 6.

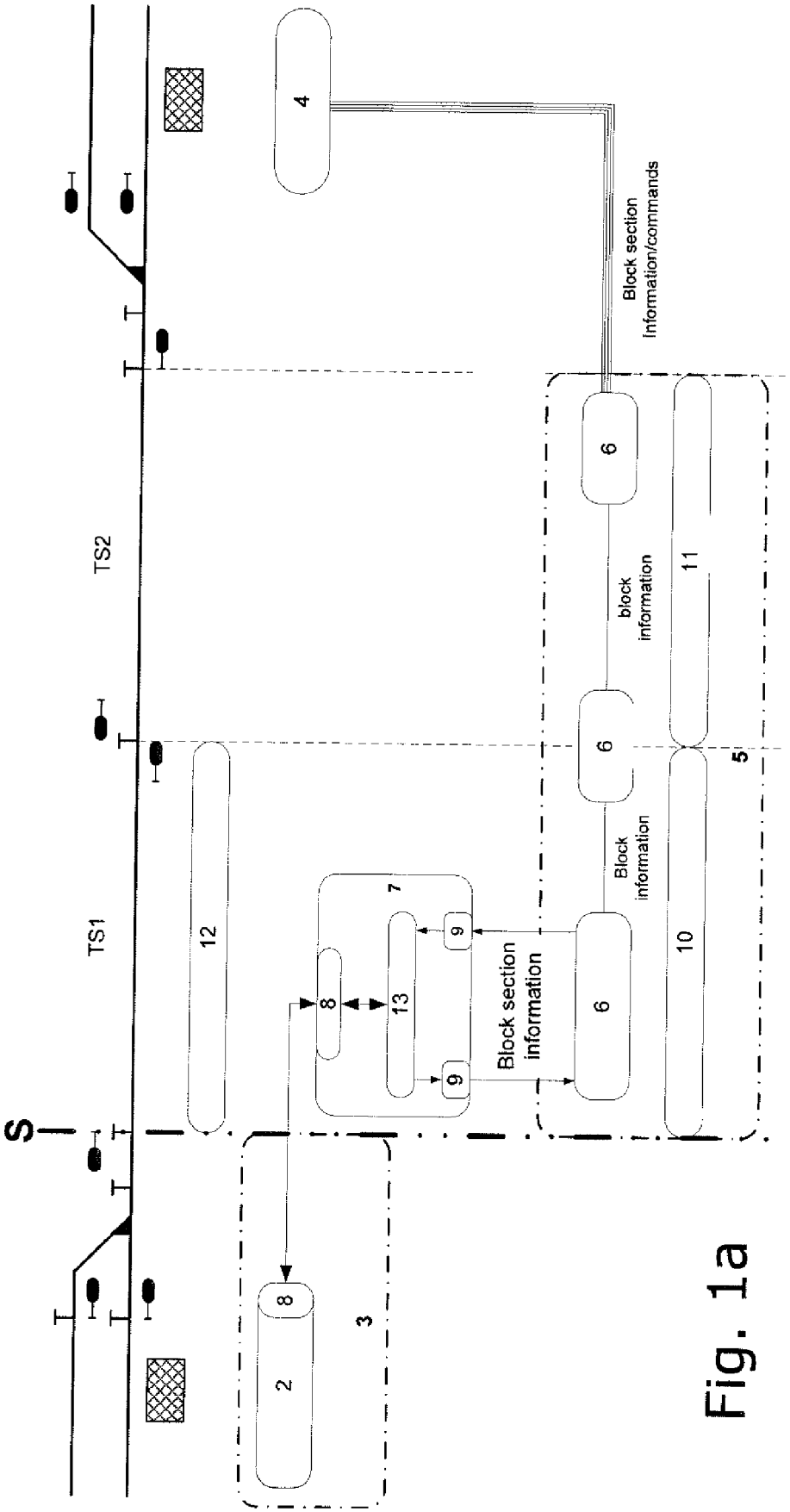
4
Block section information/commands
6
block information
11
6
Block information
5
TS2
TS1
12
7
9
8
13
9
Block section information
6
10
S
8
2
3

Fig. 1a

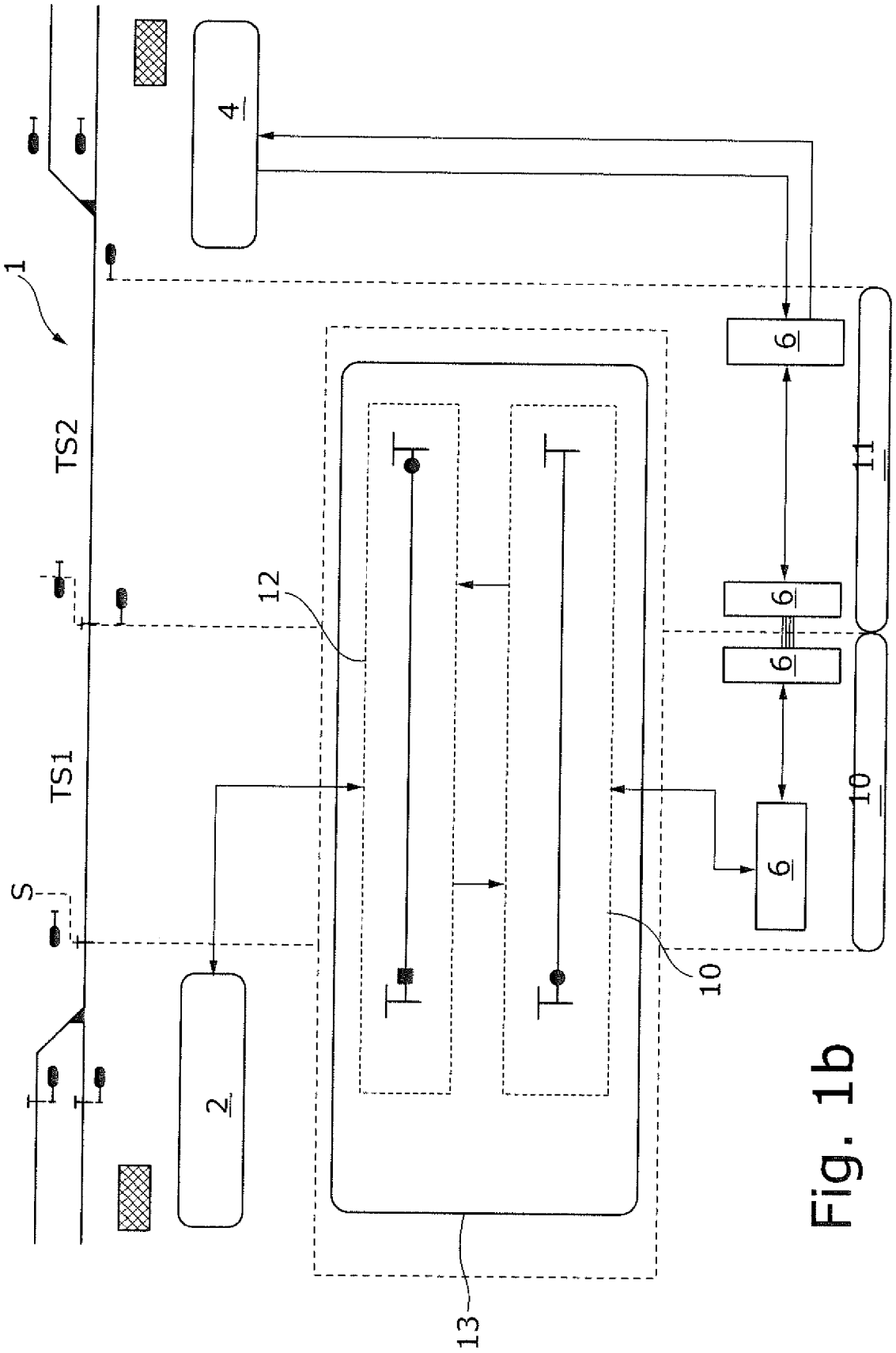

Fig. 1b

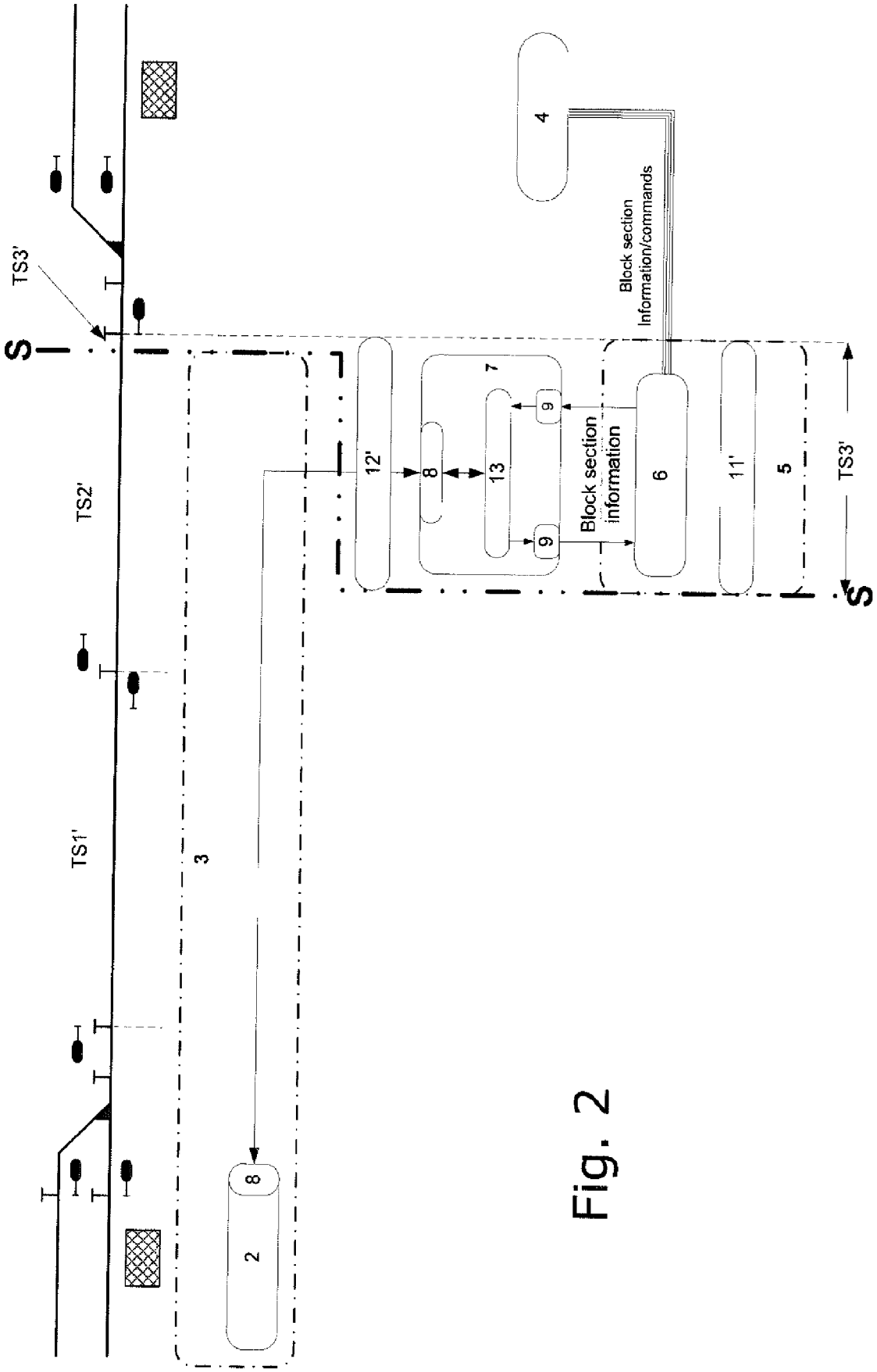
TS3'
S
TS2'
TS1'
3
2
8
12'
8
7
13
9
9
Block section information
6
4
Block section Information/commands
11'
5
TS3'
S

Fig. 2

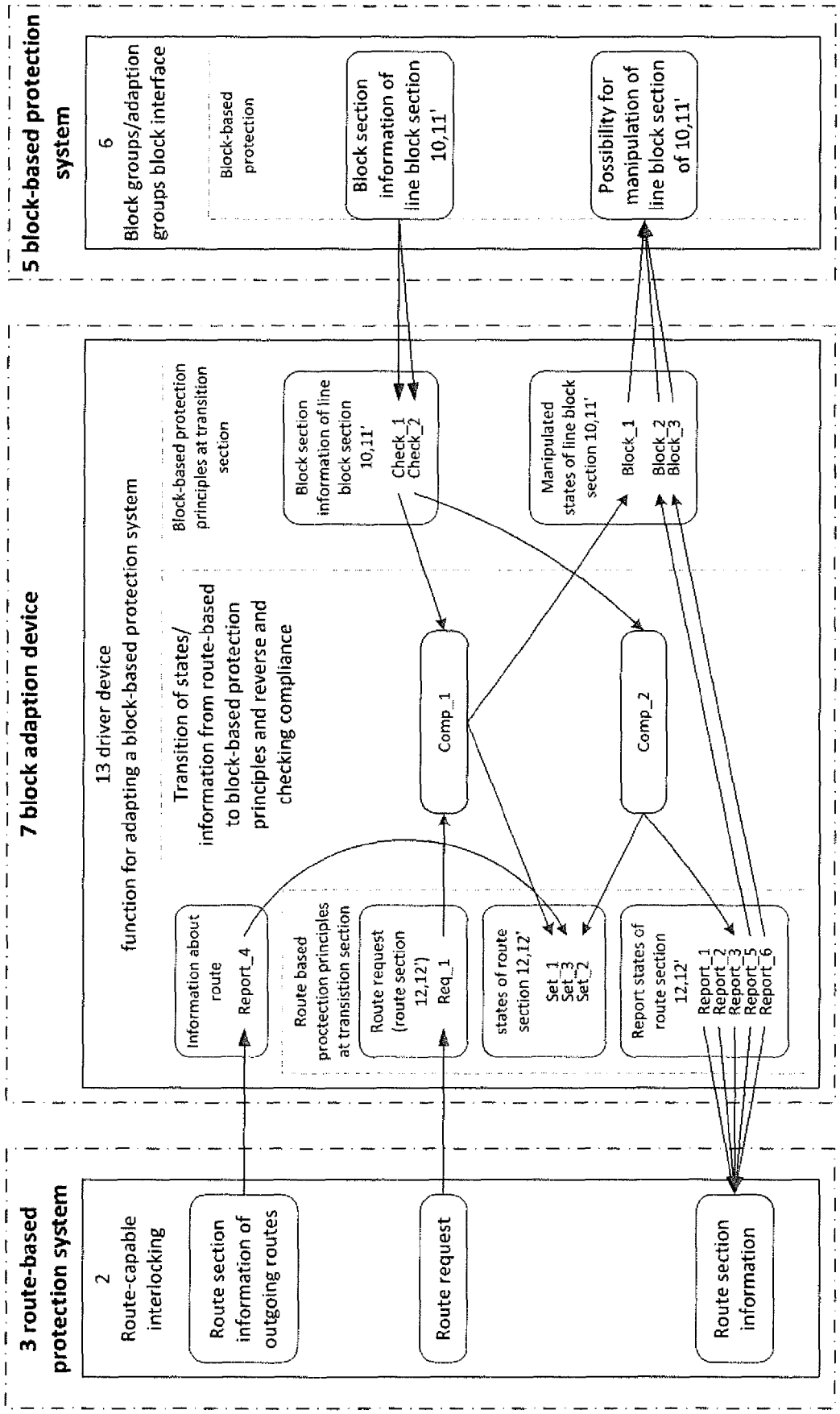
3 route-based protection system
2 Route-capable interlocking
Route section information of outgoing routes
Route request
Route section information
7 block adaption device
13 driver device function for adapting a block-based protection system
Transition of states/ information from route-based to block-based protection principles and reverse and checking compliance
Block-based protection principles at transition section
Information about route
Report_4
Route based proctection principles at transition section
Route request (route section 12,12')
Req_1
states of route section 12,12'
Set_1 Set_3 Set_2
Report states of route section 12,12'
Report_1 Report_2 Report_3 Report_5 Report_6
Comp_1
Comp_2
Block section information of line block section 10,11'
Check_1 Check_2
Manipulated states of line block section 10,11'
Block_1
Block_2 Block_3
5 block-based protection system
6 Block groups/adaption groups block interface
Block-based protection
Block section information of line block section 10,11'
Possibility for manipulation of line block section of 10,11'

Fig. 3

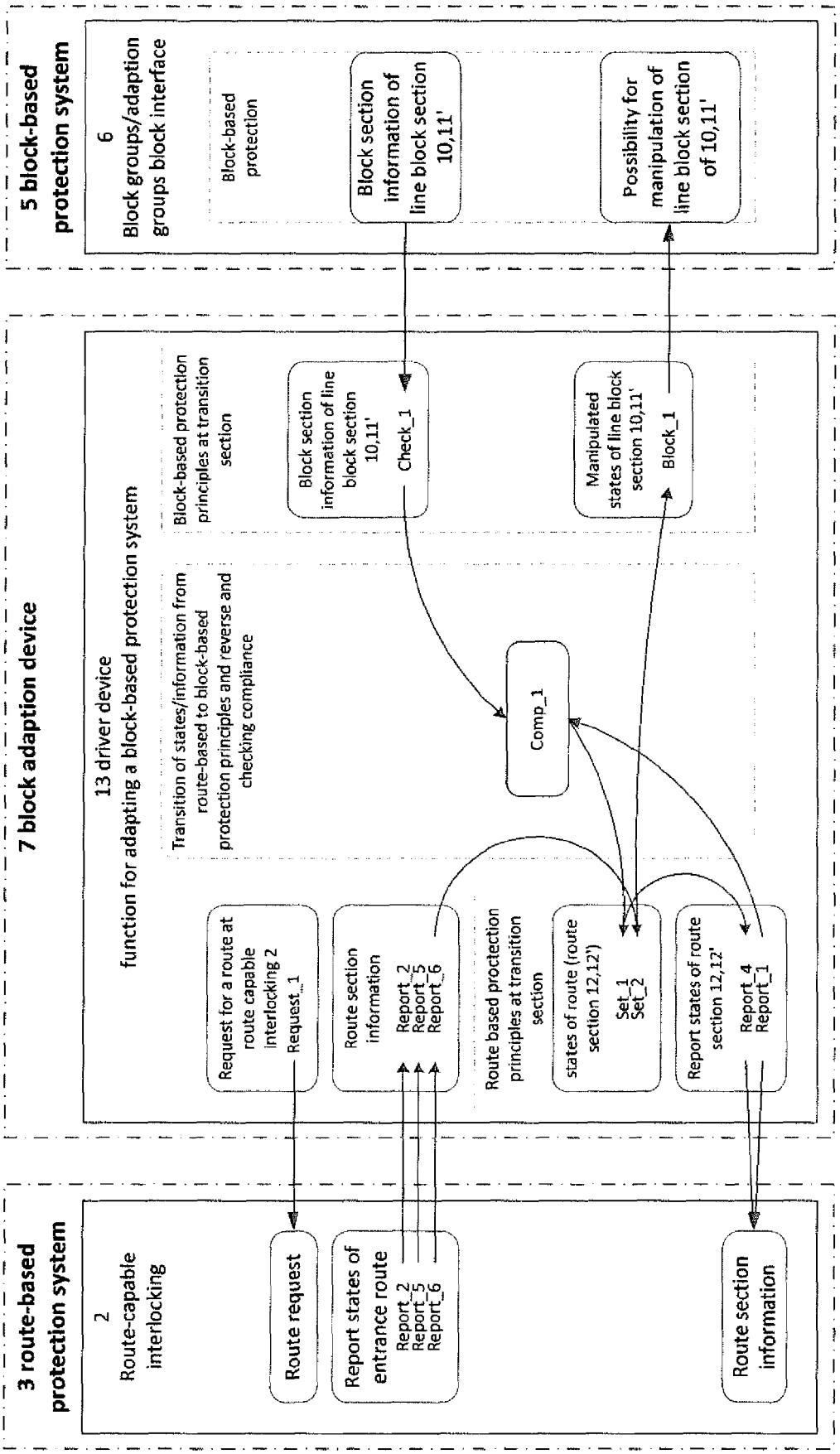
3 route-based protection system
2
Route-capable interlocking
Route request
Report states of entrance route
Report_2
Report_5
Report_6
Route section information
7 block adaption device
13 driver device
function for adapting a block-based protection system
Request for a route at route capable interlocking 2
Request_1
Route section information
Report_2
Report_5
Report_6
Transition of states/information from route-based to block-based protection principles and reverse and checking compliance
Block-based protection principles at transition section
Block section information of line block section 10,11'
Check_1
Comp_1
Route based proctection principles at transition section
states of route (route section 12,12')
Set_1
Set_2
Report states of route section 12,12'
Report_4
Report_1
Manipulated states of line block section 10,11'
Block_1
5 block-based protection system
6
Block groups/adaption groups block interface
Block-based protection
Block section information of line block section 10,11'
Possibility for manipulation of line block section of 10,11'

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 8959

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 3 176 050 A1 (HIGASHI NIPPON RYOKAKU TETSUDO [JP]) 7 June 2017 (2017-06-07) * abstract; figure 16 * * paragraphs [0174] - [0181] * * paragraphs [0016] - [0025] * -----	1-5,7,8, 10-12 6,9	INV. B61L21/04 B61L19/06 B61L23/30 B61L27/00
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TECHNICAL FIELDS SEARCHED (IPC)

B61L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 February 2018	Robinson, Victoria

CATEGORY OF CITED DOCUMENTS

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21-02-2018

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